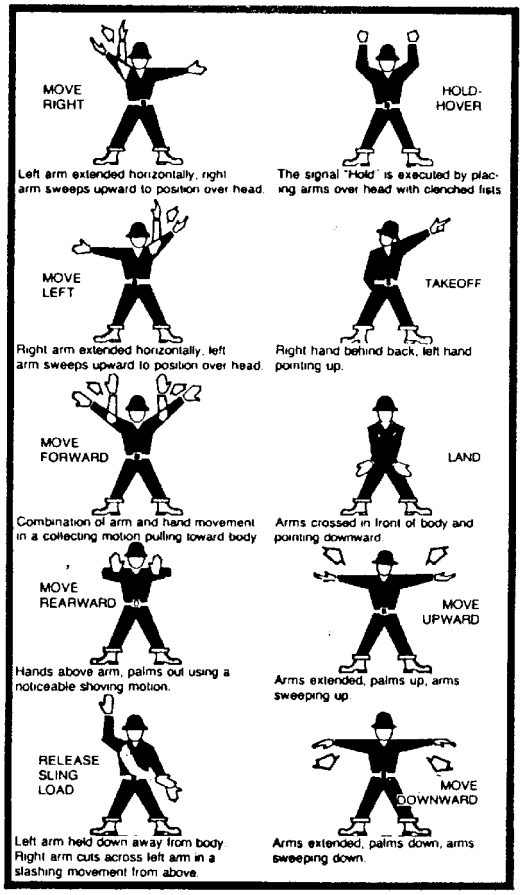
FIGURE 8-9

HELICOPTER SIGNALS



SECTION 9

FIRE PREVENTION AND PROTECTION

09.A GENERAL

09.A.01 An annual survey of the suitability and effectiveness of fire prevention and protection measures and facilities at each project or installation shall be made by a qualified person: records of the survey findings and recommendations shall be retained on file at the project or installation.

09.A.02 When unusual fire hazards exist or fire emergencies develop, additional protection shall be provided as required by the designated authority.

09.A.03 The designated authority shall survey all activities and determine which require a hot work permit.

09.A.04 Fires and open flame devices shall not be left unattended.

09.A.05 All sources of ignition shall be prohibited within 15 m (50 ft) of operations with a potential fire hazard: the area shall be conspicuously and legibly posted **NO SMOKING OR OPEN FLAME**.

09.A.06 Smoking shall be prohibited in all areas where flammable, combustible, or oxidizing materials are stored: **NO SMOKING OR OPEN FLAME** signs will be posted in all prohibited areas.

09.A.07 Areas where there is danger of underground fire shall not be used for the storage of flammable or combustible materials.

09.A.08 Noncompatible materials that may create a fire hazard shall be segregated by a barrier having a fire resistance of at least one hour.

09.A.09 Paint-soiled clothing and drop cloths, when not in use, shall be stored in well-ventilated steel cabinets or containers.

09.A.10 Insulating material with a combustible vapor barrier shall be stored at least 8 m (25 ft) from buildings or structures: only the quantity required for one day's use shall be permitted in buildings under construction.

09.A.11 Disposal of combustible waste materials shall be in compliance with applicable fire and environmental laws and regulations.

09.A.12 Paint scrapings and paint-saturated debris shall be removed from the premises on a daily basis.

09.A.13 Burning operations.

a. Burning areas shall be established in coordination with the designated authority and with the agency responsible for monitoring fire potential at the location of the proposed burning area.

b. Burning operations shall be in compliance with federal, state, and local regulations and guidelines.

c. A sufficient force to control and patrol the burning operations shall be maintained until the last embers have been extinguished.

d. Bump blocks shall be provided where trucks back to a fire or burning pit.

09.A.14 Low density fiber board, combustible insulation, or vapor barriers with a flame spread rating greater than 25 shall not be installed in permanent buildings.

09.A.15 Temporary enclosures shall be covered with flame-proof tarpaulins or material of equivalent fire-resistant characteristics.

09.A.16 When outside help is relied upon for fire protection, a

written agreement shall be made or a memorandum of record, stating the terms of the arrangement and the details for fire protection services, shall be provided to the designated government authority.

09.A.17 Temporary building spacing shall be as follows:

a. The minimum space between one-story non fire-resistive buildings shall be 6 m (20 ft).

b. The minimum space between two-story non fire-resistive buildings shall be 8 m (25 ft).

c. Buildings other than non fire-resistive buildings shall comply with recommendations of the National Fire Protection Association (NFPA).

(A group of buildings in which the total ground floor area does not exceed 185 m^2 (2,000 ft^2) shall be considered as one building for the above purpose. However, each building in the group shall be horizontally separated by at least 3 m (10 ft) on each side from other buildings.)

09.A.18 Fire lanes providing access to all areas shall be established and maintained free of obstruction.

09.A.19 Vehicles, equipment, materials, and supplies shall not be placed so that access to fire hydrants and other fire fighting equipment is obstructed.

09.A.20 Hazardous locations.

a. Electrical lighting shall be the only means of artificial illumination in areas where flammable liquids, vapors, fumes, dust, or gases are present.

b. All electrical equipment and installations in hazardous locations shall be in accordance with the National Electrical Code (NEC) for hazardous locations.

c. Globes or lamps shall not be removed or replaced nor shall repairs be made on the electrical circuit until it has been deenergized.

09.A.21 Clearance shall be maintained around lights and heating units to prevent ignition of combustible materials.

09.A.22 All combustibles shall be shielded from the flames of torches used to cut or sweat pipe.

09.A.23 Precautions shall be taken to protect formwork and scaffolding from exposure to, and spread of, fire.

09.A.24 Fire protection in the construction process.

a. Fire cut-offs shall be retained in buildings undergoing alterations or demolition until operations require their removal.

b. Where a water distribution system is required for the protection of buildings or other structures, water mains and hydrants shall be installed before or concurrent with the construction of facilities: until the permanent system is in operation, an equivalent temporary system shall be provided.

c. Permanent (fixed) extinguishing equipment and water supply for fire protection shall be installed and in operable condition as soon as possible: the scheduling of sprinkler installation shall closely follow the building construction and, following completion of each story, shall be placed in service as soon as laws permit.

d. During demolition or alterations, existing automatic sprinkler systems shall be retained in service as long as reasonable. Modification of sprinkler systems to permit alterations or additional demolition should be expedited so that the system may be returned to service as quickly as possible. Sprinkler control valves shall be checked daily at close of work to ascertain that the protection is in service. The operation of sprinkler control valves is permitted only when approved by the

designated authority.

e. During the construction process, the construction of fire walls and exit stairways required for completed buildings shall have priority; fire doors, with automatic closing devices, shall be hung on openings as soon as practical.

09.A.25 Water supply and distribution facilities for fire fighting shall be provided and maintained in accordance with recommendations of NFPA or regulations of USCG.

09.A.26 Recommendations of NFPA and regulations of the USCG shall be complied with in situations not covered in this section. Where local building codes are established, the more stringent requirements shall apply.

09.B FLAMMABLE AND COMBUSTIBLE LIQUIDS

09.B.01 All storage, handling, and use of flammable and combustible liquids shall be under the supervision of a qualified person.

09.B.02 All sources of ignition shall be prohibited in areas where flammable and combustible liquids are stored, handled, and processed: suitable **NO SMOKING OR OPEN FLAME** signs shall be posted in all such areas.

09.B.03 Fire protection requirements.

a. At least one portable fire extinguisher rated 20-B:C shall be provided on all tank trucks or other vehicles used for transporting and/or dispensing flammable or combustible liquids.

b. Each service or refueling area shall be provided with at least one fire extinguisher rated not less than 40-B:C and located so that an extinguisher shall be within 30 m (100 ft) of each pump, dispenser, underground fill pipe opening, and lubrication or service area.

09.B.04 Flammable liquids shall be kept in closed containers or tanks when not in use.

09.B.05 Workers shall guard carefully against any part of their clothing becoming contaminated with flammable or combustible fluids; they shall not be allowed to continue work if their clothing becomes contaminated and must remove or wet down the clothing as soon as possible.

09.B.06 No flammable liquid with a flash point (closed cup test) below 38° C (100° F) shall be used for cleaning purposes or to start or rekindle fires.

09.B.07 Ventilation adequate to prevent the accumulation of flammable vapors to hazardous levels shall be provided in all areas where flammable and combustible liquids are handled or used.

09.B.08 Only approved (by a nationally recognized testing laboratory) containers and portable tanks shall be used for the storage of flammable and combustible liquids.

a. Metal containers and portable tanks (less than 2.5 m^3 (660 gal) individual capacity) meeting the requirements of, and containing products authorized by, Chapter I, Title 49 of the *Code of Federal Regulations* (U.S. DOT Hazardous Materials Regulations), Chapter 9 of the United Nations Rules for the Transportation of Dangerous Goods, or NFPA 386, *Standard for Portable Shipping Tanks for Flammable and Combustible Liquids*, shall be acceptable.

b. Plastic containers meeting the requirements of, and used for petroleum products within the scope of, one or more of the following specifications shall be acceptable: ANSI/ASTM D3435, *Plastic Containers (Jerry Cans) for Petroleum Products*: ASTM F 852, *Standard for Portable Gasoline Containers for Consumer Use*; ASTM F 976, *Standard for Portable Kerosine Containers for Commercial Use*; ANSI/UL 1313, *Nonmetallic Safety Cans for Petroleum Products*.

c. Plastic drums meeting the requirements of and containing products authorized by Title 49 of the *Code of Federal Regulations* or by Chapter 9 of the United Nations' Recommendations on the Transport of Dangerous Goods shall be acceptable.

d. Fiber drums that meet the requirements of Item 296 of the National Motor Freight Classification (NMFC) or Rule 51 of the Uniform Freight Classification (UFC) for Types 2A, 3A, 3B-H, 3B-L, or 4A and meet the requirements of and contain liquid products authorized either by Chapter I, Title 49 of the *Code of Federal Regulations* (U.S. DOT Hazardous Materials Regulations) or by DOT exemption shall be acceptable.

09.B.09 Portable tanks (less than 2.5 m^3 (660 gal) individual capacity) shall be provided with one or more devices installed in the top with sufficient emergency venting capacity to limit internal pressure under fire exposure conditions to 69 kPa (10 psig) or 30% of the bursting pressure of the portable tank, whichever is greater.

a. At least one pressure-actuated vent having a minimum capacity of 170 m^3 (6000 ft^3) of free air per hour shall be used: it shall be set to open at not more than 35 kPa (5 psig).

b. If fusible vents are used, they shall be actuated by elements that operate at a temperature not exceeding 115° C (300° F).

c. Where plugging of a press-re-actuated vent can occur, fusible plugs or venting devices that soften to failure at a maximum of 115° C (300° F) under fire exposure shall be permitted to be used for the entire emergency venting requirement.

09.B.10 The design, construction, and use of storage tanks whose capacity exceeds 660 gal shall be as specified in Section 2 of NFPA 30, *Flammable and Combustible Liquids Code*.

09.B.11 The maximum allowable size for a container or metal portable tank (less than 2.5 m^3 (660 gal) individual capacity) shall not exceed the following:

Container type	Flammable Liquids Class			Combustible Liquids Class	
	IA	IB	IC	II	III
Glass	473 mL	946 mL	3.8 L	3.8 L	3.8 L
Metal (other than DOT drums) or approved plastic	3.8 L	19 L	19 L	19 L	19 L
Safety cans	7.6 L	19 L	19 L	19 L	19 L
Metal drum (DOT specification)	0.23 m^3	0.23 m^3	0.23 m^3	0.23 m^3	0.23 m^3
Approved metal portable tank	2.5 m^3	2.5 m^3	2.5 m^3	2.5 m^3	2.5 m^3
Polyethylene DOT Spec 34, UN 1H1, or as authorized by DOT Exemption	3.8 L	19 L	19 L	0.23 m^3	0.23 m^3
Fiber drum NMFC or UFC Type 2A, Types 3A, 3B-H, or 3B-L, or Type 4A	-	-	-	0.23 m^3	0.23 m^3

09.B.12 Storage cabinets and areas.

a. The design, construction, and use of storage cabinets shall be as specified in Section 4-3 of NFPA 30, *Flammable and Combustible Liquids Code*.

b. The design, construction, and use of indoor storage areas shall be as specified in Sections 4-4 through 4-6 of NFPA 30, *Flammable and Combustible Liquids Code*.

c. The design, construction, and use of outdoor storage areas shall be as specified in Section 4-7 of NFPA 30, *Flammable and Combustible Liquids Code*.

d. Fire protection and storage for storage cabinets and areas shall be as specified in Section 4-8 of NFPA 30, *Flammable and Combustible Liquids Code*.

09.B.13 Flammable and combustible liquids in quantities greater than that required for one day's use shall not be stored in buildings under construction and not more than a two-day supply shall be stored on paint barges.

09.B.14 Flammable and combustible liquids shall not be stored in areas used for exits, stairways, or safe passage of people.

09.B.15 Safety cans and other portable containers for flammable liquids having a flash point at or below 23° C (73° F) shall be painted red with a yellow band around the can and the name of the contents legibly indicated on the container.

09.B.16 Unopened containers of flammable and combustible liquids, such as paints, varnishes, lacquers, thinners, and solvents, shall be kept in a well-ventilated location, free of excessive heat, smoke, sparks, flame, or direct rays of the sun.

09.B.17 In areas where flammable and combustible liquids are handled or stored, a self-closing metal refuse can, listed by a nationally recognized testing laboratory, shall be provided and maintained in good condition.

09.B.18 Where liquids are used or handled, provisions shall be made to promptly and safely dispose of leakage or spills.

09.B.19 Flashlights and electric lanterns used during handling of flammable and combustible liquids shall be listed by a nationally recognized testing laboratory for use in such hazardous areas.

09.B.20 Dispensing flammable and combustible liquids-general.

a. All pumping equipment used for the transfer of flammable

and combustible liquids shall be listed by a nationally recognized testing laboratory or approved by, and labeled or tagged in accordance with, the federal agency having jurisdiction, such as the DOT.

b. Flammable liquid dispensing systems shall be electrically bonded and grounded. All fuel tanks, hoses, and containers of 19 L (5 gal) or less shall be kept in metallic contact while flammable liquids are being transferred; transfer of flammable liquids in containers in excess of 19 L (5 gal) shall be done only when the containers are electrically bonded.

c. Flammable or combustible liquids shall be drawn from, or transferred into, vessels, containers, or tanks within a building or outside only through a closed piping system, from safety cans, by means of a device drawing through the top, or from a container, or portable tanks, by gravity or pump, through an approved self closing valve. Transferring by means of air pressure on the container or portable tanks is prohibited.

d. Areas in which flammable or combustible liquids are transferred in quantities greater than 19 L (5 gal) from one tank or container to another shall be separated from other operations by at least 8 m (25 ft) or a barrier having a fire resistance of at least one hour. Drainage or other means shall be provided to control spills. Natural or mechanical ventilation shall be provided to maintain the concentration of flammable vapor at or below 10% of the lower flammable limit.

e. Dispensing units shall be protected against collision damage.

f. Dispensing nozzles and devices for flammable liquids shall be of an approved type.

g. Lamps, lanterns, heating devices, and similar equipment shall not be filled while hot: these devices shall be filled only in well-ventilated rooms free of open flames or in open air and shall not be filled in storage buildings.

09.B.21 Service and refueling areas.

a. Dispensing hoses shall be of an approved type; dispensing nozzles shall be an approved automatic-closing type without a latch-open device.

b. Equipment using flammable liquid fuel shall be shut down during refueling, servicing, or maintenance: this requirement may be waived for diesel fueled equipment serviced by a closed system with attachments designed to prevent spillage.

c. Dispensing of flammable fluids from tanks of 0.21 m^3 (55 gal) capacity or more shall be by approved pumping arrangement. Transferring by air pressure on the container or portable tank is prohibited.

d. Clearly identified and easily accessible switch(es) shall be provided at a location remote from dispensing devices to shut off the power to all dispensing devices in an emergency.

09.B.22 Tank cars/trucks.

a. Tank cars/trucks shall be spotted and not loaded or unloaded until brakes have been set and wheels chocked.

b. Tank cars/trucks shall be attended for the entire time they are being loaded or unloaded. Precautions shall be taken against fire or other hazards.

c. Tank cars/trucks shall be properly bonded and grounded while being loaded or unloaded. Bonding and grounding connections shall be made before dome covers are removed on tank cars/trucks and shall not be disconnected until such covers have been replaced. Internal vapor pressure shall be relieved before dome covers are opened.

09.C LIQUEFIED PETROLEUM GAS (LP-GAS)

09.C.01 Storage, handling, installation, and use of LP-Gases and systems shall be in accordance with NFPA Standard 58 and

USCG regulations, as applicable.

09.C.02 LP-Gas containers, valves, connectors, manifold valve assemblies, regulators, and appliances shall be of an approved type.

09.C.03 Any appliance that was originally manufactured for operation with a gaseous fuel other than LP-Gas and is in good condition may be used with LP-Gas only after it is properly converted, adapted, and tested for performance with LP-Gas.

09.C.04 Polyvinyl chloride and aluminum tubing shall not be used in LP-Gas systems.

09.C.05 Safety devices.

a. Every container and vaporizer shall be provided with one or more safety relief valves or devices. These valves and devices shall be arranged to afford free vent to the outside air and discharge at a point not less than 2 m (5 ft) horizontally from any building opening that is below the discharge point.

b. Container safety relief devices and regulator relief vents shall be located not less than 2 m (5 ft) in any direction from air openings into sealed combustion system appliances or mechanical ventilation air intakes.

c. Shut-off valves shall not be installed between the safety relief device and the container, or the equipment or piping to which the safety relief device is connected, except that a shut-off valve may be used where the arrangement of the valve is such that full required capacity-flow through the safety relief device is always afforded.

09.C.06 Container valves and accessories.

a. Valves, fittings, and accessories connected directly to the container, including primary shut off valves, shall have a rated working pressure of at least 1725 kPa (250 psig) and shall be of material and design suitable for LP-Gas service.

b. Connections to containers - except safety relief connections, liquid level gauging devices, and plugged openings - shall have shutoff valves located as close to the container as practical.

09.C.07 Multiple container systems.

a. Valves in the assembly of multiple container systems shall be arranged so that replacement of containers can be made without shutting off the flow of gas in the system (this is not to be construed as requiring an automatic changeover device).

b. Regulators and low-pressure relief devices shall be rigidly attached to the cylinder valves, cylinders, supporting standards, building walls, or otherwise rigidly secured and shall be installed or protected from the elements.

09.C.08 LP-Gas containers and equipment shall not be used in unventilated spaces below grade in pits, below-decks, or other spaces where dangerous accumulations of heavier-than-air gas may accumulate due to leaks or equipment failure.

09.C.09 Welding is prohibited on LP-Gas containers.

09.C.10 Dispensing.

a. Equipment using LP-Gas shall be shut down during refueling operations.

b. Filling of fuel containers for motor vehicles from bulk storage containers shall be performed not less than 3 m (10 ft) from the nearest masonry-walled building, not less than 8 m (25 ft) from the nearest building of other construction, and, in any event, not less than 8 m (25 ft) from any building opening.

c. Filling, from storage containers, of portable containers or containers mounted on skids shall be performed no less than 15 m (50 ft) from the nearest building.

09.C.11 Installation, use, and storage outside buildings.

a. Containers shall be upright upon firm foundations or otherwise firmly secured. Flexible connections (or other special fixtures) shall be provided to protect against the possibility of the effect of settlement on the outlet piping.

b. Containers shall be in a suitable ventilated enclosure or otherwise protected against tampering.

c. Storage outside buildings, of containers awaiting use, shall be located from the nearest building or group of buildings in accordance with the following:

Quantity of LP-Gas stored	Distance
less than 227 kg (500 lb)	0 m
227 kg (500 lb) - 2730 kg (6,000 lb)	3 m (10 ft)
2730 kg (6,000 lb) - 4545 kg (10,000 lb)	6 m (20 ft)
more than 4545 kg (10,000 lb)	8 m (25 ft)

d. Storage areas shall be provided with at least one approved portable fire extinguisher rated no less than 20-B:C.

09.C.12 Use inside buildings.

a. LP-Gas shall not be stored within buildings.

b. Containers, regulating equipment, manifolds, pipe, tubing, and hose shall be located to minimize exposure to high temperatures or physical damage.

c. The maximum water capacity of individual containers shall be 110 kg (245 lbs) (nominal 45 kg (100 lbs) LP-Gas capacity).

d. Containers having a water capacity greater than 1 kg (2.5 lbs) (nominal 0.5 kg (1 lb) LP-Gas capacity) which are connected for use shall stand on a firm and substantially level surface and, when necessary, shall be secured in an upright position. Systems utilizing containers having a water capacity greater than 1 kg (2.5 lbs) shall be equipped with excess flow

valves internal either with the container valves or in the connections to the container valve outlets.

e. Regulators shall be directly connected to either the container valves or to manifolds connected to the container valves. The regulator shall be suitable for use with LP-Gas. Manifolds and fittings connecting containers to pressure regulator inlets shall be designed for at least 1725 kPa (250 psi) gauge service pressure.

f. Valves on containers having water capacity greater than 23 kg (50 lbs) (nominal 9 kg (20 lbs) LP-Gas capacity) shall be protected from damage while in use or storage

g. Hose shall be designed for a working pressure of at least 1725 kPa (250 psi) gauge. Design, construction, and performance of hose and connections shall have been suitability determined by listing by a nationally recognized testing agency. Hose length shall be as short as possible but long enough to permit compliance with spacing requirements without kinking, straining, or causing the hose to be so close to a burner as to be damaged by heat.

09.D TEMPORARY HEATING DEVICES

09.D.01 Only temporary heating devices approved by the designated authority shall be used. Each heater should have a safety data plate permanently affixed by the manufacturer. The plate shall provide requirements or recommendations for:

a. clearances from combustible materials,
b. ventilation (minimum air requirements for fuel combustion),
c. fuel type and input pressure,
d. lighting, extinguishing, and relighting,
e. electrical power supply characteristics,
f. location, moving, and handling, and
g. name and address of the manufacturer.

> if this information is not available on a data plate it shall be

in writing at the job site

09.D.02 A positive operating procedure shall be established to assure the following:

a. proper placement and servicing,
b. safe clearance from combustible material,
c. close surveillance,
d. safe fuel storage and refueling,
e. proper maintenance, and
f. ventilation and determination of gaseous contamination or oxygen deficiency.

09.D.03 Heater installation and maintenance shall be in accordance with the manufacturer's instructions.

09.D.04 Open-flame heating devices having exposed fuel below the flame are prohibited.

09.D.05 Heaters, when in use, shall be set horizontally level, unless otherwise permitted by the manufacturer's specifications.

09.D.06 Heaters unsuitable for use on wood floors shall be so marked. When such heaters are used, they shall rest on suitable heat insulating material, such as concrete of at least 2.5 cm (1 in) thickness or equivalent; the insulating material shall extend 0.6 m (2 ft) or more in all directions from the edges of the heater.

09.D.07 Heaters used near combustible tarpaulins, canvas, or similar coverings shall be located at least 3 m (10 ft) from such coverings; coverings shall be securely fastened to prevent them from igniting or upsetting the heater due to wind action.

09.D.08 Heaters shall be protected against damage.

09.D.09 Installation of temporary heating devices shall provide minimum clearances to combustible materials as specified in the following table.

Heater type	Sides	Rear	Chimney connector
room heater - circulating	30 cm	30 cm	45 cm
room heater - radiant	90 cm	90 cm	45 cm

09.D.10 Fuel combustion space heating devices used in any enclosed building, room, or structure shall be vented by a flue pipe to the exterior of the structure.

a. Fresh air shall be supplied, by natural or mechanical means, in sufficient quantities to ensure the health and safety of workers. Particular attention shall be given to areas where heat and fumes may accumulate.

b. When heaters are used in confined spaces, precautions shall be taken to ensure proper combustion, maintenance of a safe and healthful atmosphere for workers, and limitation of temperature rise in the area: these precautions shall be addressed in the confined space entry permit. ***> See Section 06.1***

c. Vent pipes shall be located a safe distance from flammables and combustibles. Where vent pipes pass through combustible walls or roofs, they shall be properly insulated and securely fastened and supported to prevent accidental displacement or separation.

09.D.11 When a heater is placed in operation, initial and periodic checks shall be made to ensure it is functioning properly.

09.D.12 Fuel combustion heater carbon monoxide hazards.

a. When heaters are used in enclosed or partially enclosed structures, tests for the presence of carbon monoxide shall be made within one hour of the start of each shift and at least every four hours (every two hours for solid fuel heaters) thereafter.

b. Carbon monoxide concentrations greater than 25 ppm (TLV)

of air volume at worker breathing levels shall require extinguishing of the heater unless additional ventilation is provided to reduce the carbon monoxide content to acceptable limits.

09.D.13 Personnel involved in fueling heaters shall be trained in, and thoroughly familiar with, the manufacturer's recommended safe fueling procedures.

09.D.14 Heaters shall be equipped with an approved automatic device to shut off the flow of fuel if the flame is extinguished (on liquid fuel heaters, barometric or gravity oil feed shall not be considered a primary safety control).

09.D.15 Spark arresters shall be provided on all smoke stacks or burning devices having forced drafts or short stacks permitting live sparks or hot materials to escape.

09.D.16 Solid fuel heaters are prohibited in buildings and on scaffolds.

09.D.17 Gas heaters - general.

a. All piping, tubing, and hose shall be leak tested - using soap suds or other noncombustible detection means (tests shall not be made with a flame) - after assembly and proven free of leaks at normal operating pressure.

b. Hose and fittings shall be protected from damage and deterioration.

c. All hose and fittings shall be checked to ensure that the type, capacity, and pressure ratings are as specified by the heater manufacturer: hose shall have a minimum working pressure or 1725 kPa (250 psi) gauge and a minimum bursting pressure of 8620 kPa (1250 psi) gauge.

d. All hose connectors shall be capable of withstanding, without leakage, a test pressure of 860 kPa (125 psi) gauge and shall be capable of withstanding a pull test of 180 kg (400 lbs).

e. Hose connectors shall be securely connected to the heater by mechanical means; neither "slip-end" connectors (connections that allow the hose end to be held only by the friction of the hose material against the metal fitting of the unit) nor ring keepers (tightened over the hose to provide an increased force holding the hose to the metal fitting) are permitted.

09.D.18 Natural gas heaters. When flexible gas supply lines are used, the length shall be as short as practical and shall not exceed 8 m (25 ft).

09.D.19 Portable LP-Gas heaters. ***> See also Section 09.C***

a. If LP-Gas is supplied to a heater by hose, the hose shall not be less than 3 m (10 ft), nor more than 8 m (25 ft), in length.

b. Heaters shall be equipped with an approved regulator in the supply line between the fuel cylinder and the heater unit. Cylinder connectors shall be provided with an excess flow valve to minimize the flow of gas in the event the fuel line ruptures.

c. LP-Gas heaters having inputs above 50,000 Btu per hour shall be equipped with either a pilot, which must be lighted and proved before the main burner can be turned on, or an electronic ignition. (These provisions do not apply to portable heaters under 7,500 Btu per hour when used with containers having a maximum water capacity of 1 kg (2.5 lbs).)

d. Container valves, connectors, regulators, manifolds, piping, and tubing shall not be used as structural support for LP-Gas heaters.

e. Heaters, other than integral heater-container units, shall be located at least 2 m (6 ft) from any LP-Gas container (this shall not prohibit the use of heaters designed specifically for attachment to the LP-Gas container or to a supporting standard, provided they are designed and installed to prevent direct or radiant heat application from the heater into the containers).

Blower and radiant type heaters shall not be directed toward any LP-Gas container within 6 m (20 ft).

f. If two or more heater-container units (of either the integral or nonintegral type) are located in an unpartitioned area of the same floor, the container or containers of each unit shall be separated from the container or containers of any other unit by at least 6 m (20 ft).

g. When heaters are connected to containers for use in an unpartitioned area on the same floor, the total water capacity of containers, manifolded together for connection to a heater(s), shall not be greater than 335 kg (735 lb) (nominal 136 kg (300 lb LP-Gas capacity). Such manifolds shall be separated by at least 6 m (20 ft).

09.D.20 Installation of heating equipment in service or lubrication areas.

a. Heating equipment installed in lubrication or service areas where there is no dispensing or transferring of flammable liquids shall be installed such that the bottom of the heating unit is at least 46 cm (18 in) above the floor and is protected from damage.

b. Heating equipment installed in lubrication or service areas where flammable liquids are dispensed shall be of a type approved for garages and shall be installed at least 2 m (8 ft) above the floor.

09.E FIRST RESPONSE FIRE PROTECTION

09.E.01 Portable fire extinguishers shall be provided where needed as specified in Table 9-1. Fire extinguishers shall be inspected and maintained as specified in NFPA 10.

09.E.02 Approved fire extinguishers.

a. Fire extinguishers shall be approved by a nationally

FIGURE 9-1

FIRE EXTINGUISHER DISTRIBUTION

	Occupancy					
	Low Hazard		Medium Hazard		High Hazard	
	Class A	Class B	Class A	Class B	Class A	Class B
Mimimum rating for single extinguisher	2-A	5-B or 10-B(1)	2-A	10-B or 20-B	4-A	40-B or 80-B (2)
Maximum coverage (floor area) per unit of A-rating	3,000 sq ft	n/a	1,500 sq ft	n/a	1,000 sq ft	n/a
Maximum floor area for extinguisher	11,250 sq ft	n/a	11,250 sq ft	n/a	11,250 sq ft	n/a
Maximum travel distance to extinguisher	75 ft	30 ft for 5-B 50 ft for 10-B	75 ft	30 ft for 10-B 50 ft for 20-B	75 ft	30 ft for 40-B 50 ft for 80-B

(1) up to three floam extinguishers of at least 2-1/2 gal capacity may be used to fulfill low hazard requirements
(2) up to three aqueous film foaming foam (AFFF) extinguisher of at least 2-1/2 gal capacity may be used to fulfill high hazard requirements

Derived from NFPA 10
In multiple-story facilities, at least one extinguisher shall be adjacent to stairways.
On construction and demolition projects, a ½ in diameter garden hose, not to exceed 100 ft in length and equipped with a nozzle, may be substituted for a 2-A rated fire extinguisher provided it is capable of discharging a minimum of 5 gal per minute with minimum hose stream range of 30 ft horizontally. The garden hose lines shall be mounted on conventional racks or reels. The number and location of hose racks or reels shall be such that at least one hose stream can be applied to all points in the area.

recognized testing laboratory and labeled to identify the listing and labeling organization and the fire test and performance standard that the fire extinguisher meets or exceeds.

b. Fire extinguishers shall be marked with their letter (class of fire) and numeric (relative extinguishing effectiveness) classification.

c. Fire extinguishers using carbon tetrachloride or chlorobromomethane extinguishing agents are prohibited.

d. Soldered or riveted shell self-generating foam or gas cartridge water-type portable extinguishers which are operated by inverting the extinguisher to rupture or initiate an uncontrollable pressure generating chemical reaction to expel the agent are prohibited.

09.E.03 Fire extinguishers shall be in a fully charged and operable condition and shall be suitably placed, distinctly marked, and readily accessible.

09.E.04 When portable fire extinguishers are provided for employee use in the workplace, the employer shall provide training (upon initial employment and at least annually thereafter) in the following:

a. general principles of fire extinguisher use and the hazards involved with incipient stage fire fighting to all employees; and
b. use of the appropriate fire fighting equipment to those employees designated in an emergency action plan to use fire fighting equipment.

09.E.05 Approved fire blankets shall be provided and kept in conspicuous and accessible locations as warranted by the operations involved.

09.E.06 No fire shall be fought where the fire is in imminent danger of contact with explosives: all persons shall be removed to a safe area and the fire area guarded against intruders.

09.E.07 Standpipe and hose system equipment.

a. Standpipes shall be located or otherwise protected against damage: damaged standpipes shall be repaired promptly.

b. Reels and cabinets used to contain fire hose shall be designed and maintained to ensure the prompt use of the hose valve, hose, and other equipment. Reels and cabinets shall be conspicuously identified and used only for fire equipment.

c. Hose outlets and connections shall be located high enough above the floor to avoid their obstruction and to be accessible to employees. To ensure hose connections are compatible with support fire equipment, screw threads shall be standardized or adapters shall be provided throughout the system.

d. Standpipe systems shall be equipped with vinyl type or lined hoses of such length that friction loss resulting from water flowing through the hose will not decrease the pressure at the nozzle below 210 kPa (30 psi). The dynamic pressure at the nozzle shall be within 210 kPa (30 psi) and 860 kPa (125 psi).

e. Standpipe hoses shall be equipped with shut-off type nozzles.

09.E.08 The following tests shall be performed on standpipe and hose systems before placing them in service:

a. piping (including yard piping) shall be hydrostatic tested for at least two hours at not less than 1380 kPa (200 psi) (or at least 350 kPa (50 psi) in excess of normal pressure when the normal pressure is greater than 1040 kPa (150 psi)); and
b. hose shall be hydrostatic tested with couplings in place at a pressure of not less than 1380 kPa (200 psi) (this pressure shall be maintained for at least 15 seconds, but not more than one minute, during which time the hose shall not leak nor shall the jacket thread break).

09.E.09 Standpipe and hose system inspection and maintenance.

a. Water supply tanks shall be kept filled to the proper level except during repairs. When pressure tanks are used, proper pressure shall be maintained at all times except during repairs.

b. Valves in the main piping connections to the automatic sources of water supply shall be kept fully open at all times except during repairs.

c. Hose systems shall be inspected at least annually and after each use to assure that all equipment is in place, available for use, and in operable condition.

d. When the system or any portion of the system is found not to be serviceable it shall be removed for repair and replaced with equivalent protection (such as fire watches and extinguisher) until the repairs are complete.

e. Hemp and linen hoses shall be unracked, physically inspected for deterioration, and reracked using a different fold pattern at least annually.

09.E.10 The minimum water supply for standpipe and hose systems provided for the use of employees shall be sufficient to provide 0.38 m^3 (100 gal) per minute for at least 30 minutes.

09.E.11 For all structures in which standpipes are required, or where standpipes exist in structures being altered, the standpipes shall be brought up as soon as practical and maintained as construction progresses so that they are always ready for fire protection use. There shall be at least one standard hose outlet at each floor.

09.F FIXED FIRE SUPPRESSION SYSTEMS

09.F.01 Fixed fire suppression systems shall be designed, installed, and acceptance-tested in accordance with requirements of the NFPA.

09.F.02 Fixed fire suppression systems shall be inspected and maintained in accordance with the applicable NFPA standards. Inspection and maintenance dates shall be recorded on the container, on a tag attached to the container, or in a central location.

09.F.03 Automatic sprinkler systems shall be protected from damage.

09.F.04 Vertical clearance of at least 46 cm (18 in) shall be maintained between the top of stored material and sprinkler deflectors.

09.F.05 If a fixed extinguishing system becomes inoperable, the employer shall notify the employees and take necessary precautions to assure their safety until the system is restored to operating order.

09.F.06 Effective safeguards shall be provided to warn employees against entry into fixed extinguishing system discharge areas where the atmosphere remains hazardous to employee safety and health. Manual operating devices shall be identified as to the hazard against which they will provide protection.

09.F.07 Warning or caution signs shall be posted at the entrance to, and inside, areas protected by fixed extinguishing systems which use agents in concentrations known to be hazardous to employee safety and health.

09.F.08 Dry chemical fixed extinguishing systems.

a. Dry chemical extinguishing agents shall be compatible with any foams or wetting agents with which they are used.

b. Dry chemical extinguishing agents of different compositions shall not be mixed together.

c. Dry chemical extinguishing systems shall be refilled with the chemical stated on the approval nameplate or an equivalent compatible material.

09.F.09 Gaseous agent fixed extinguishing systems.

a. Agents used for initial supply and replenishment shall be of a type approved for the system's application (carbon dioxide obtained by dry ice conversion to liquid is not acceptable unless it is processed to remove excess oil and water).

b. Employees shall not be exposed to toxic levels of the gaseous agent or its decomposition products.

09.F.10 When water and spray foam fixed extinguishing systems are used, the drainage of water shall be away from work areas and routes of emergency egress.

09.G FIRE FIGHTING EQUIPMENT

09.G.01 Fire fighting equipment shall be provided and installed in accordance with applicable NFPA, OSHA, and USCG regulations.

09.G.02 No fire protection equipment or device shall be made inoperative or used for other purposes, unless specifically approved by the designated authority (for Government facilities, this includes the Government's designated authority).

09.G.03 If fire hose connections are not compatible with local fire fighting equipment, adapters shall be made available.

09.H FIRE DETECTION AND EMPLOYEE FIRE ALARM SYSTEMS

09.H.01 Fire detection and employee fire alarm systems shall be designed and installed in accordance with requirements of NFPA and OSHA.

09.H.02 Fire detection systems and components shall be restored to normal operating condition as soon as possible after each test/alarm. Spare devices and components shall be maintained in sufficient quantities for the prompt restoration of the system.

09.H.03 Fire detection systems shall be maintained in operable condition except during maintenance or repairs.

a. Fire detectors and detector systems shall be tested and adjusted as often as necessary to maintain operability and reliability: factory calibrated detectors need not be adjusted after installation.

b. Pneumatic and hydraulic operated detection systems installed after January 1, 1981, shall be equipped with supervised systems.

c. The servicing, testing, and maintenance of fire detection systems shall be performed by a trained person knowledgeable in the operations and function of the system.

d. Fire detectors that need to be cleaned of dirt, dust, or other particulate matter to be fully functional shall be cleaned at regular intervals.

09.H.04 Fire detection systems and devices shall be protected from weather, corrosion, and mechanical and physical damage.

09.H.05 Fire detectors shall be supported independently of their control wiring or tubing.

09.H.06 An alarm system shall be established by the employer so that employees on the site and the local fire department can be alerted of an emergency.

09.H.07 Manually operated alarm actuation devices shall be conspicuous and accessible and inspected and maintained in operable condition.

09.H.08 The alarm shall be distinctive and recognizable as a signal to evacuate the work area or to perform actions designated in the emergency action plan.

a. The alarm shall be capable of being perceived above

ambient noise and light levels by all employees in the affected area.

b. Tactile devices may be used to alert those employees who would not otherwise be able to recognize the audible or visual alarm.

09.H.09 Employees shall be instructed in the preferred means of reporting emergencies, such as manual pull box alarms, public address systems, or telephones.

a. The alarm code and reporting instructions shall be conspicuously posted at phones and at employee entrances.

b. Reporting and evacuating instructions shall be conspicuously posted.

c. For work at installations which are equipped with radio wave fire alarm systems, a compatible fire alarm transmitter should be used at the construction site.

09.I FIRE FIGHTING ORGANIZATIONS - TRAINING AND DRILLING

09.I.01 Fire fighting organizations shall be provided to assure adequate protection to life and property. NFPA recommendations shall be used for determining type, size, and training of fire fighting organizations.

09.I.02 Fire brigade drills shall be held to assure a well-trained and efficient operating force. Records of such drills shall be maintained at the installation.

09.I.03 Demonstration and training in first aid fire fighting shall be conducted at intervals to insure that project personnel are familiar with, and capable of operating, fire fighting equipment.

09.J FIRE PATROLS

09.J.01 When watch personnel or guards are provided, they shall

make frequent rounds through buildings and storage areas when work is suspended.

09.J.02 Watch personnel or guards shall be provided where ten or more persons are quartered.

09.J.03 In any instance where combustible materials have been exposed to fire hazards (such as welding operations, hot metals, or open flame), a watcher shall be assigned to remain at the location for at least one hour after the exposure has ended.

09.K WILDFIRE CONTROL

09.K.01 At all facilities and areas with potential exposure to wildfire, a wildfire prevention plan shall be developed. The plan shall address the following items and shall be updated annually:

a. an analysis of wildfire causes and special fire hazards and risks;
b. proposed measures to reduce fire occurrence and decrease fire damage;
c. procedures for public education and fire prevention sign posting (including procedures for keeping the public informed of the current fire danger rating); and
d. provisions for cooperative efforts with all other neighboring fire protection agencies.

09.K.02 At all facilities and areas with potential exposure to wildfire, a wildfire control plan shall be developed. The plan shall address the following items, shall be distributed to all key wildfire control officers, and shall be updated at least annually:

a. the in-house wildfire control team organization and personnel roster, training and equipment requirements, and notification procedures;
b. a listing of cooperating agencies and notification procedures, (including any mutual aid agreements with adjacent fire departments and agencies);
c. a listing of additional available resources for work force, equipment, supplies, and facilities, and contracting or

procurement information;
d. an up-to-date map of the protected area which shows boundaries, roads, and other means of access, heliports, airports, water sources, special hazards, and special fire risks;
e. a listing of weather information sources;
f. procedures for public notification; and
g. pre-attack plans.

09.K.03 Wildfire control teams and operations shall be organized and conducted in accordance with the requirements of NFPA 295.

a. Wildfire control team personnel shall receive training as specified by the fire chief; as a minimum, training will include fireline safety, fire behavior, suppression methods, communications procedures, and use and care of protective and firefighting equipment.

b. Fire fighting equipment shall be maintained in working and ready condition.

c. Protective equipment, including fire helmet, leather boots, goggles, and gloves, shall be provided and maintained in working and ready condition. ***> See also Section 5***

d. Employees designated as fire fighters shall be examined, as part of their medical surveillance, by a physician and certified to be physically able to perform fire fighting duties.

e. Communication equipment shall be provided to fire fighters as necessary for coordination, control, and emergency needs.

09.K.04 Wildfire control teams shall consist of two or more qualified individuals.

DEFINITIONS

Automatic fire detection device: a device designed to automatically detect the presence of fire by heat, flame, light, smoke, or other products of combustion.

Carbon dioxide: a colorless, odorless, electrically nonconductive inert gas which acts as an extinguishing medium by reducing the concentration of oxygen or fuel vapor in the air to the point where combustion is impossible.

Class A fire: a fire involving ordinary combustible materials such as wood, paper, clothing, and some rubber and plastic materials.

Class B fire: a fire involving flammable or combustible liquids, flammable gases, greases and similar materials, and some rubber and plastic materials.

Class C fire: a fire involving energized electrical equipment where safety to the employee requires the use of electrically nonconductive extinguishing media.

Class D fire: a fire involving combustible metals such as magnesium, zirconium, sodium, and potassium.

Combustible liquid - a liquid having a flash point at or above 38° C (100° F). Combustible liquids are subdivided as follows:
€ Class II liquids have flash points at or above 38° C (100° F) and below 60° C (140° F).
€ Class IIIA liquids have flash points at or above 60° C (140° F) and below 93° C (200° F).
€ Class IIIB liquids have flash points at or above 93° C (200° F).

Container: any vessel of 0.23 m^3 (60 gal) or less capacity used for transporting or storing liquids.

Dry chemical: an extinguishing agent composed of very small particles of chemicals such as sodium bicarbonate, potassium bicarbonate, or potassium chloride supplemented by special treatment to provide resistance to packing and moisture absorption and to provide proper flow capabilities. Does not include dry powders.

Dry powder: a compound used to extinguish or control Class D fires.

Extinguisher classification: the letter classification given an extinguisher to designate the class(es) of fire on which it will be effective.

Extinguisher rating: the numerical rating given to an extinguisher which indicates the extinguishing potential of the unit.

Fixed extinguishing system: a permanently installed system that either extinguishes or controls a fire.

Flammable liquid - a liquid having a flashpoint below 38° C (100° F) and having a vapor pressure not exceeding 280 kPa (40 psia) at 38° C (100°F). Flammable liquids are also categorized as Class I liquids and further defined as follows:
Class 1A liquids have flash points below 23° C (73° F) and have boiling points below 38° C (100° F).
Class 1B liquids have flash points below 23° C (73° F) and have boiling points at or above 38° C (100° F).
Class 1C liquids have flash points at or above 23° C (73° F) and below 38° C (100° F).

Foam: a stable aggregation of small bubbles which flow freely over a burning liquid surface and form a coherent blanket which seals combustible vapors, thereby extinguishing the fire.

Gaseous agent: a fire extinguishing agent which is in the gaseous state at normal room temperature and pressure and diffuses readily to diffuse itself uniformly throughout an enclosure.

Halon: a colorless, electrically nonconductive gas which extinguishes fire by inhibiting the chemical chain reaction of fuel and oxygen. Halon 1211 is a liquefied gas, also known as bromochlorodifluromethane; halon 1301 is also known as bromotrifluoromethane.

Incipient stage fire: a fire which is in the initial or beginning stage and which can be controlled or extinguished by portable fire extinguisher, Class II standpipe, or small hose systems without the need for protective clothing or breathing apparatus.

Liquefied petroleum gas (LPG): any material which is composed predominantly of any of the following hydrocarbons (or mixtures of them): propane, propylene, butanes, and butylenes.

Local application system: a fixed fire suppression system which has a supply of extinguishing agent with nozzles arranged to automatically discharge extinguishing agent directly on the burning material to extinguish or control the fire.

Multipurpose dry chemical: a dry chemical which is approved for use on Class A, Class B, and Class C fires.

Portable tank: any closed vessel having a liquid capacity over 0.23 m^3 (60 gal) and not intended for fixed installation.

Pre-discharge employee alarm: an alarm which will sound at a set time before actual discharge of an extinguishing system so that employees may evacuate the discharge area before system discharge.

Safety can: an approved container, of not more than 19 L (5 gal) capacity, having a spring-closing lid and spout cover and designed to safety relieve internal pressures under fire exposure.

Sprinkler alarm: an approved device installed so that any discharge from a sprinkler system equal to or greater than that from a single automatic sprinkler will result in an audible signal on the premises.

Sprinkler system: a system of piping designed in accordance with fire protection engineering standards and installed to control, or extinguish fires. The system includes an adequate and reliable water supply, a network of specialty sized piping and sprinklers which are interconnected, and a control valve and device for actuating an alarm when the system is in operation.

Small hose system - a system of hose, ranging in diameter from 1.6 cm (5/8 in), which is for use by employees and provides a means for the control and extinguishment of incipient stage fires.

Standpipe system:
Class I standpipe system - a 6.4 cm (2-1/2 in) hose connection for use by fire departments and those trained in handling heavy fire streams.
Class II standpipe system - a 3.8 cm (1-1/2 in) hose system which provides a means for the control or extinguishment of incipient stage fires.
Class III standpipe system - a combined system of hose which is for use by employees trained in the use of hose operations and which is capable of furnishing effective water discharge during the more advanced stages of fire (beyond the incipient stage) in the interior of workplaces.

Storage tank: any vessel having a liquid capacity that exceeds 60 gal, is intended for fixed installation and is not used for processing.

Total flooding systems: a fixed suppression system which is arranged to automatically discharge a predetermined concentration of agent into an enclosed space for fire extinguishment or control.

SECTION 10

WELDING AND CUTTING

10.A GENERAL

10.A.01 Welders, cutters, and their supervisor shall be trained in the safe operation of their equipment, safe welding/cutting practices, and welding/cutting respiratory and fire protection.
> American Industrial Hygiene Association publication "Welding Health and Safety" is recommended

10.A.02 All welding equipment shall be inspected daily: defective equipment shall be removed from service, replaced or repaired, and reinspected before again being placed in service.

10.A.03 Electrical and pressurized system requirements.

a. Welding cylinders and their use shall meet the applicable requirements of Section 20, Pressurized Systems.

b. Arc welding and cutting systems and their use shall meet the applicable requirements of Section 11, Electrical.

10.A.04 Workers and the public shall be shielded from welding rays, flashes, sparks, molten metal, and slag.

10.A.05 Cable, hoses, and other equipment shall be kept clear of passageways, ladders, and stairways.

10.A.06 Welding and cutting of hazardous materials.

a. When welding, cutting, or heating on steel pipelines containing natural gas, 49 CFR Part 192, Welding of Steel in Pipelines, shall apply.

b. Before welding, cutting, or heating is commenced on any surface covered by a preservative coating whose flammability is not known, a test shall be made to determine its flammability: preservative coatings shall be considered highly flammable